

# NOAA SECTORAL APPLICATIONS RESEARCH PROGRAM (SARP)

## PROJECT ANNUAL REPORT (DRAFT)

### PROJECT TITLE

Climatic Variability and Social Transition: Implications for Management of Urban Water Supplies in Arid Portions of India

### INVESTIGATORS

*(Research team and full contact information)*

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PROJECT YEARS      2007-2009

TIME PERIOD ADDRESSED BY REPORT *(e.g., August 2002-March 2003)*

August 2007-April 2008

## I. PRELIMINARY MATERIALS

### A Project Abstract *(Limit to one page)*

Climatic variability and widespread overdraft of groundwater resources coupled with processes of socio-economic transition are major factors contributing to urbanization in India. As recent research conducted by ISET and a broad network of partners in South Asia documents, populations in areas affected by water scarcity are adapting by shifting from agricultural to non-farm and urban-based livelihoods. This shift is contributing to the rapid growth of demographic and infrastructure pressures in periurban and urban areas. It is particularly evident in regions where long-term processes of groundwater overdraft have depleted the availability of local water supplies for buffering the impacts of climatic variability on agriculture. Secure water supplies for domestic use are, however, still essential. Adaptation by moving to urban/periurban areas and shifting livelihoods depends on “the ability of households to obtain access to secure sources of water for domestic uses, whether from local or trans-boundary sources, water markets or supply schemes” (Moench and Dixit 2004). With water supplies for urban areas already under severe pressure, the above process raises major questions regarding the sustainability of sources for meeting the additional domestic water needs. Furthermore, because transitions to urban livelihoods are pulsed (people shift in response to droughts and other similar events) and dynamic (the process isn’t one-way), urban water supply needs are difficult to project and many populations remain un-served by municipal systems. The problem is, in essence, threefold: (1) to project and define the relationship between climatic and water resource conditions on one side and likely population pulses between urban/periurban and rural areas on the other side; (2) to

ensure clean and safe water supplies are physically available that can meet the changing needs of migrants for domestic and livelihood uses; and (3) to deliver supplies to vulnerable (often transient) populations, particularly in areas that are not served by piped systems. Addressing the above problem in a way that catalyzes attention and action requires approaches to research that actively engage key private, public and non-government actors. It also requires evaluation of current policies and projects governing the provision of water supplies to migrant populations.

Our overall goal in this project is to undertake detailed case studies of two rapidly growing urban areas in India that document the interaction between climate, water resource and wider processes of economic change in migration to urban areas and the growing importance of non-farm, urbanized livelihood systems. This will be done in a manner that actively engages key constituencies in the research process. In doing so, our objective is to combine the generation of new insights on social dynamics with the identification of emerging needs and audiences for climate, weather and water information.

The project will build on an extensive program of prior research and current partnerships in the region. Dr. Moench, the lead investigator, is trained in hydrogeology and institutional economics and has worked extensively on climate adaptation and water resources in India. He led the groundwater component of the India Water Sector Review for the Government of India and World Bank and has collaborated on projects in Rajasthan for over a decade. In addition to his academic position at the Institute for Development Studies-Jaipur, Dr. M.S. Rathore is an economist, has worked on the issues of urban water management and climate change, and specializes in policy analysis. Dr. Rathore also serves on various committees for the Government of Rajasthan and provides advice across the spectrum from local NGOs to the state's political leadership. The work proposed under this project will contribute to a larger program of research on adaptation to climatic variability and change that is funded by numerous organizations including Canada's International Development Research Centre (IDRC) and, for coastal and flood affected regions, the NOAA SARP program. These associated projects strongly support and contribute to the activities proposed here.

#### B Objective of Research Project (*Limit to one paragraph*)

The project will involve two years of research in Rajasthan, India. Our goal will be to investigate: (1) the dynamic interaction between climatic variability, groundwater overdraft and migrant inflows to the city of Jaipur; (2) options for managing water supply sources to meet the new domestic and commercial needs of immigrants under existing and projected climatic conditions; and (3) physical and institutional systems for meeting the highly dynamic requirements of migrant populations and the new or emergent economic systems on which their livelihoods are based. The project will focus particularly on the ways in which climate and water resource information can be combined with insights from the above to predict and plan for future needs. It will also focus on ways of increasing the utility of such information for users ranging from official government and development organizations to municipalities, the private sector, NGOs and community groups.

#### C Approach (including methodological framework, models used, theory developed and tested, project monitoring and evaluation criteria) include a description of the key

beneficiaries of the anticipated findings of this project (e.g., decision makers in a particular sector/level of government, researchers, private sector, science and resource management agencies) (*Limit to one page*)

The project will rely on shared learning dialogues supported by more conventional survey, field research, modeling and secondary data/literature based techniques. Shared learning dialogues, an ongoing series of thematically focused discussion sessions, are used extensively by ISET as a mechanism for collection of key information/data and to engage key actors in the research process. These dialogues can engage the numerous organizations that work on thematic issues in ways that encourage their direct input to the way core research questions are framed, the details of field surveys and baseline information collection and the structuring of models. This gives access to the extensive insights and data that organizations have already collected. It also helps frame the research in ways that ensure results are of direct relevance to local decision-makers. Furthermore, by engaging such organizations, the research process becomes itself a mechanism for dissemination and effecting knowledge-based change at policy and operational levels.

The shared learning dialogues will be supported by: (1) surveys and qualitative interviews in migrant source and destination areas, undertaken in a way that actively engages public (government), private, community and non-government actors; (2) collection of existing primary and secondary data on climatic variability, migration and water resource conditions; (3) documentation and analysis of water supply institutions and delivery systems; and (4) development of urban water supply scenarios under differing climate and migration conditions using the WEAP modeling system developed by the Stockholm Environment Institute.

The research plan is straightforward. The local lead investigator, Dr. M.S. Rathore, is already engaged with key regional actors in policy forums that address basic water and climate related issues. Through his academic and research positions, Dr. Rathore regularly hosts policy debates/meetings with a wide array of stakeholders across the state.

We will start by synthesizing existing information and hosting a series of initial shared learning dialogues with carefully selected contacts. This will indicate where to focus specific elements of the more detailed research. Field surveys will follow, and at the same time, a simplified regional water demand and supply model will be developed using the WEAP modeling system. This model will be used to depict existing water supply conditions and their relationship to both climatic and socioeconomic factors in the selected urban area. With this, available projections of climate change will be used to illustrate scenarios regarding future conditions. Modeling scenarios will be used to bound anticipated future conditions and to identify future climate/weather information needs and the constituencies demanding such information.

The final step in the research process will involve synthesizing results, subjecting this synthesis to peer review by those engaged in the shared learning dialogues and dissemination. Aside from the shared learning dialogues, conventional dissemination methodologies including extensive publication in peer-reviewed journals, presentation in regional and international meetings and hosting of local workshops will be used.

D Description of any matching funds/activities used in this project (*Limit to one paragraph*)  
None.

## II. ACCOMPLISHMENTS

- A. Brief discussion of project timeline and tasks accomplished. Include a discussion of data collected, models developed or augmented, fieldwork undertaken, or analysis and/or evaluation undertaken, workshops held, training or other capacity building activities implemented. (*This can be submitted in bullet form – limit to two pages*)

Project activities were slightly delayed initially due to an administrative change in the institutional umbrella under which Dr. Rathore would be working for this project and we wished to obtain approval from NOAA on this before beginning. It was approved. The following is a progress report from Dr. Rathore on the work carried out during the reporting period in Rajasthan.

### **Progress report from Dr. Rathore covering this reporting period:**

- 1 Collection of Government of Rajasthan's reports from PHED, Irrigation Department, Jaipur Development Authority, Agriculture Department, Economics and Statistics Department, maps, secondary data on population, land use, agricultural water demand, etc. for Jaipur district and the surrounding districts falling in the Banas River Basin. Data entry work is under progress.
- 2 Information on Jaipur City- present and future water demand based on the State Urban development Master Plan. Also information on changes in the peri-urban areas around Jaipur within the radius of 50km.
- 3 Conducted survey to collect primary data on the migrant population in Jaipur City through different routes and different destinations, nature of migration (push and pull factors) and increased water demand. Source of water supply and present and future water demand.
- 4 Identification of parameters for WEAP and Climate Change models, data collection and data entry in progress.
- 5 Discussed contents of main report and prepared outline for four research papers during the Kathmandu meeting in March 2008.
- 6 Visit to Banas River Basin and Bisalpur Dam (source of future drinking water supply to Jaipur City) to identify data needs for modeling and status of land use, water use, state and people's development interventions in the hydrological system in the Basin.
- 7 Review of literature is also in progress. Waiting for WEAP and Climate Change Model input from ISET experts.

ISSET recruited a new researcher with expertise in climatology to assist with research for this project. Mr. MacClune's first trip to the project field are is described in his report that follows.

### **Report from field trip to Jaipur city and surrounding areas within the Banas Basin:**

Dates of trip: March 28 to April 3

The trip encompassed several days over which two full day meetings with Dr. Rathore were held, a three day visit to the Banas River Basin was made, and a visit to several sites of the informal water sector and informal day labour market were made.

On day one I met with Dr. M.S. Rathore at his office at IDS-Jaipur to review the plans for my visit. We discussed the geography and geology of the Banas River basin and its various tributaries. We also discussed the climatology of the region and reviewed some of the published historical data on precipitation and temperature. In addition to discussing the upcoming trip through the basin we discussed our approach to addressing the issue of climate change and its affects on the Banas River and the people of Jaipur.

Day two was the first day of a three day trip to visit the Banas River Basin. We drove approximately 420 km from Jaipur to Udaipur. Along the way we visited a medium level water project where we took a one and a half kilometre hike to reach the spillway of an earthen dam that was built along a tributary of the Banas River. We stopped at several tributary rivers to witness how people were interacting with them and how they were managed. We also witnessed how drinking water is supplied and used in many villages and towns in the river basin. We saw industrial locations such as the zinc plant on the outskirts of town and learned of other industrial users such as the phosphate mining operation; most of these industries are major groundwater consumers. We also took note of the various methods in use for supplying water for agriculture.

Day three we reviewed present and historic water usage and management in Udaipur and met with the director of a local institute. We reviewed geological maps of the local region and discussed groundwater and its use. We then proceeded to the town of Chittaurgarh making several stops along the way at different rivers and villages and making note, as we did the day prior, on water source and use.

On day four we drove from Chittaurgarh back to Jaipur. Outside of Chittaurgarh we visited another medium level water project. On this leg of the trip we also visited the Bisalpur Dam which was constructed to hold up to 315.5 MCM of water. At the dam we witnessed present water diversion projects as well as the construction of a new ~9m pipeline designed to supply reservoir water to the city of Jaipur, and projected to come on-line within the next year.

On day five I met once again with Dr. Rathore in Jaipur to discuss the Banas River Basin trip and the impressions I had as well as some of the ideas that came to me about the project during that time.

The final day in Jaipur I travelled to several sites within the city to see informal water markets, how they are supplied, and where and how water is sold. I also visited several sites where people congregate for the informal day labour market.

I gained a great deal of knowledge about the cultural and social context and geo-physics of water in the Banas River Basin that will be essential in understanding how climate change will affect water availability in this region in the future.

B. Summary of findings, including their potential or actual implications for efforts to develop applications, methods, and science-based decision support capacity/systems and to foster sustainable resource management and vulnerability reduction. *(Limit to two pages)*

Too early in the project to assess any findings.

C. List of any reports, papers, publications or presentations arising from this project; please send any reprints of journal articles as they appear in the literature. Indicate whether a paper is formally reviewed and published. *(No text limit)*

None yet.

D. Discussion of any significant deviations from proposed workplan (e.g., shift in priorities following consultation with program manager, delayed fieldwork due to late arrival of funds, obstacles encountered during the course of the project that have impacted outcome delivery). *(Limit to one paragraph)*

As mentioned above, there was a slight delay in initiating project activities due to an administrative change in the institutional umbrella under which Dr. Rathore would be working for this project. We wished to obtain approval from NOAA on this before beginning. It was approved.

E. Where appropriate, describe the climate information products and forecasts considered in your project (both NOAA and non-NOAA); identify any specific feedback on the NOAA products that might be helpful for improvement. *(bulleted response)*

A simplified regional water demand and supply model will be developed using the WEAP modeling system (a system both local organizations have used in prior projects). This model will, in a simplified manner, be used to depict existing water supply conditions and their relationship to both climatic and socioeconomic factors in the selected urban area.

Once a model that captures existing baseline conditions has been created, information from the field surveys will be combined with historical water resource and climatic data combined with available projections of climate change to illustrative scenarios regarding future conditions. New versions of WEAP are particularly suited for this since they enable projections of water supply dynamics using weather and climate parameters rather than stream flow.

Field survey data and modeling scenarios will be jointly interpreted with local actors using a second round of shared learning dialogues. This interpretation process will involve local actors

directly in the generation of insights by assisting them to generate “what if” variations on model scenarios – thus testing the implications of assumptions and observations. These “what if” scenarios will be used to bound anticipated future conditions and to identify future climate/weather information needs and the constituencies demanding such information.

**III. GRAPHICS: PLEASE INCLUDE THE FOLLOWING GRAPHICS AS ATTACHMENTS TO YOUR REPORT**

- A. One Power point slide depicting the overall project framework/approach/results to date
- B. If appropriate, additional graphic(s) or presentation(s) depicting any key research results thus far
- C. Photographs (if easy to obtain) from fieldwork to depict study information (if applicable).

**IV. WEBSITE ADDRESS FOR FURTHER INFORMATION (IF APPLICABLE)**

**V. ADDITIONAL RELEVANT INFORMATION NOT COVERED UNDER THE ABOVE CATEGORIES.**



Aquifer access in the Rajasthan desert, India